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March 22, 2000

BOX PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Re: Application of **Jacques JOLLY, Remi FAUCHE,** and **Jean-Florent CAMPION**

A METHOD OF MANUFACTURING AN OPTICAL FIBER PREFORM AND MORE PARTICULARLY A PREFORM OF LARGE DIAMETER
Our Ref. Q58469

Dear Sir:

Attached hereto is the application identified above including 15 sheets of the specification, claims and abstract, 1 sheet of formal drawings, executed Assignment and PTO 1595 form, and executed Declaration and Power of Attorney. Also enclosed is the Information Disclosure Statement.

The Government filing fee is calculated as follows:

Total claims	8	- 20	= 0	x	$18.00	=	$.00
Independent claims	1	- 3	= 0	x	$78.00	=	$.00
Base Fee							$690.00
TOTAL FILING FEE							**$690.00**
Recordation of Assignment							$40.00
TOTAL FEE							**$730.00**

Checks for the statutory filing fee of $690.00 and Assignment recordation fee of $40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. § 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from April 01, 1999 based on French Application No. 9904074. The priority document is enclosed herewith.

Respectfully submitted,
SUGHRUE, MION, ZINN,
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A METHOD OF MANUFACTURING AN OPTICAL FIBER PREFORM AND MORE PARTICULARLY A PREFORM OF LARGE DIAMETER

The invention relates to a method of manufacturing optical fiber preforms, which method is more particularly intended for manufacturing preforms of large diameter.

BACKGROUND OF THE INVENTION

A known method of manufacturing or building up, i.e. "overcladding", preforms designed for the production of optical fibers makes provision to deposit silica on a primary preform which is equipped with supporting end-pieces at its ends, and which is carried by means enabling it to move along its axis and to rotate relative to a flame of an inductive plasma torch, into which silica grains are injected and in which they are melted. That method makes it possible to manufacture a preform of determined thickness, starting from a primary preform that is thinner, by superposing a succession of concentrically-deposited layers of silica. The respective lengths of the successive layers decrease so that the thickness of deposited silica that covers the preform and its end-pieces tapers uniformly towards the ends, from a central segment of determined length and diameter. A conical shape is imparted to one of the ends of each preform so as to facilitate the subsequent fiber-drawing operations starting from said end.

It is known that the desired conical shape at the fiber-drawing end of the preform can be obtained by drawing the end-pieces of the preform as overclad with silica in opposite directions, after the preform has been locally melted by being heated to the core, in a zone of the central segment that is situated in the vicinity of the end to be made conical. Such drawing makes it possible to separate the preform from one of its two supporting end-pieces. The intense heating performed for drawing purposes suffers from the drawback of giving rise to high silica evaporation, the evaporated silica then cooling and forming soot which falls back in particular

on the preform. Such soot affects the transparency of the preform and increases its roughness.

In order to remedy those drawbacks, the Applicant's Document EP-A-0 831 070 makes provision to perform the separation in two steps. A first drawing step causes the diameter of the preform in the zone that is heated for cleaving purposes to be reduced to a chosen diameter that is usually close to the diameter of a supporting end-piece. A glazing operation is provided for removing the unwanted deposit that has formed on the cold portions of the preform that have received soot during the heating performed for the first drawing step. The glazing is performed by passing the preform through the flame of the plasma torch without any material being supplied. A second drawing step terminates the separation in the smaller-diameter zone that is heated to the core for that purpose. The quantities of silica evaporated and re-deposited are small because of the small dimensions of the zone that is then heated.

That method including two separation steps is quite suitable when the preforms to be cleaved are of diameter that is not too large, e.g. of maximum diameter of about 80 mm.

However, it is not suitable when the preform diameter is such that heating to the core is lengthy and difficult to perform, thus making it difficult to obtain sufficient softening of the preform in the separation zone in which the drawing-apart is to be performed.

In addition, prolonged heating of a large-diameter preform gives rise to considerable silica evaporation from the heated zone, and causes a thick layer to be re-deposited on the cold portions of the preform and in particular on the portion close to the region that is to constitute the cone. That thick re-deposited layer does not necessarily vitrify properly during the intermediate glazing operation, and can give rise to a non-homogeneous zone that could disturb fiber drawing.

OBJECTS AND SUMMARY OF THE INVENTION

To remedy those drawbacks, the invention provides a method of manufacturing or building up, i.e. "overcladding", an optical fiber preform in an installation provided with means enabling a preform held horizontally at its ends between two mounting points by supporting end-pieces to be rotated axially and to be moved relatively in translation. Heater means for heating the preform by means of a plasma torch, which heater means are disposed radially relative to said preform are associated with material supply means, so as to enable the preform to be manufactured in successive passes corresponding to the preform and the torch being displaced relative to each other, with or without material being supplied, these displacements therefore leading either to a new layer of material being deposited on the preform, or to the most recent layer deposited being glazed.

According to a characteristic of the invention, the method makes provision to interpose a one-ended reduction in the length of at least one layer, during a pass and starting from one of the intermediate layers, while a succession of concentric layers of material are being deposited on the preform in a manner such that the respective lengths of the layers, which lengths are determined by the preform/torch relative displacements, are progressively shortened as a result of a progressive reduction in the lengths of the displacements, so that the thickness of deposited material that covers the preform and a portion of each of the end-pieces decreases uniformly towards the ends, said one-ended reduction in layer length leading to a limitation of the thickness of material deposited on one of the end-pieces and on a limited-length preform zone that is longitudinally adjacent to said end-piece, at the level set by the layer deposited immediately prior to said one-ended reduction.

According to a characteristic of the invention, the method includes at least one hot drawing operation performed to separate a preform from one of the end-pieces in said limited-length preform zone which is adjacent to said end-piece, after said succession of layers required for forming the preform has been deposited.

According to a characteristic of a variant of the invention, the method includes a hot-drawing operation performed in two steps, separated by a preform glazing operation, in said limited-length preform zone which is adjacent to an end-piece so as to separate the preform and said end-piece, the first drawing step being associated with heating to the core causing softening by melting in said limited-length preform zone, and producing a reduction in diameter, the second step also being associated with heating to the core causing softening by melting and achieving full separation.

BRIEF DESCRIPTION OF THE DRAWING

The invention, its characteristics and its advantages appear more clearly in the following description given with reference to the below-listed figures, in which:

Figure 1 is a diagrammatic view of a known installation making it possible to implement the method of the invention for producing a preform;

Figure 2 is a diagrammatic view of a preform made using the method of the invention; and

Figure 3 is a diagrammatic view of a preform of the invention as obtained after separation.

MORE DETAILED DESCRIPTION

The installation shown diagrammatically in Figure 1 is assumed to make it possible to manufacture or to build up or "overclad" optical fiber preforms. The installation makes it possible to obtain an overclad preform 1 starting from a primary preform 2, of axis 4,

such an overclad preform being known from the prior art and shown diagrammatically in Figure 2.

The installation includes means 3 of the lathe type making it possible to rotate the preform axially as it is held horizontally at its ends via end-pieces 6a, 6b between two mounting points 3a, 3b. As is known, the end-pieces are previously fixed to the ends of the primary preform. One of them, referenced 6a in this example, remains secured to the finally-obtained preform, while the other, referenced 6b in this example, is separated from the final preform so that an optical fiber can be obtained by performing a fiber-drawing operation known to the person skilled in the art.

The installation also includes plasma torch heater means 5 which are more generally positioned radially relative to the preform when said preform is held horizontally between the mounting points 3a, 3b. Material supply means (not shown) are associated with the plasma torch. They are conventionally used to inject grains of silica into the flame of the torch which melts said grains. The torch is positioned in known manner such that silica is deposited in localized manner on the preform. By moving the preform and the torch relative to each other, it is possible to deposit silica on a zone of limited width over the length of the preform, and by rotating the preform, it is possible to cover the entire preform with a deposit. It is possible for the torch to be displaced in translation relative to the preform, but the torch is more conventionally mounted on a lathe, and said lathe causes the preform as held by its ends to move in translation relative to the torch which is then fixed.

Overcladding a primary preform, such as 2' in Figure 2, so as to obtain a preform 1 or 1' that can be used to produce a fiber, is performed by implementing successive passes to deposit a succession of superposed concentric layers. It is known that the lengths of the successive layers can be reduced progressively by

progressively reducing the lengths of the preform/torch relative displacements parallel to the axis 4 of the preform. It is thus possible to make the thickness of deposited material that covers the primary preform and a portion of each of its end-pieces decrease progressively at the two ends and on either side of a central segment of uniform diameter, as shown in Figure 1.

It is necessary to separate one of the end-pieces from the finally-obtained preform in order to obtain an end from which a fiber can be produced. That operation is performed by drawing after intensive heating in a limited zone of the preform where the glass is softened by melting so as to facilitate separation. High silica evaporation is produced during that operation and the evaporated silica falls back down in the form of soot that solidifies on the coldest portions of the preform on which it is deposited.

To remedy that drawback, Document EP-A-0 831 070 makes provision to perform the separation in two steps, between which a glazing stage is interposed. The glazing stage aims to remove the silica that has been re-deposited during the first of the separation steps. During the first step, the diameter of the preform 1, as fully overclad, is annularly reduced to a value which corresponds, for example, to the diameter of an end-piece, in a determined zone 10 in which the separation is to take place. As shown in Figure 1, this zone 10 is chosen to be in the vicinity of the end-piece 6b to be removed, and following on from the portion 9 of the preform that is constituted by the successive deposition of layers of silica on the primary preform and on the end-piece 6b, where they are joined together prior to separation.

The intensive heating that is performed by means of the plasma torch 5 during the second step and that accompanies the separation performed by drawing the preform 1 and the end-piece 6b apart, gives rise to only

a limited evaporation of silica. The evaporation and the corresponding re-deposition are thus significantly smaller than those produced during the preceding step, insofar as the softening to be performed affects only the zone 10 and therefore concerns only a relatively small quantity of silica.

However, as indicated, that solution is not always fully satisfactory in particular when cleaving is to be performed on a preform of large diameter.

In the invention, efforts are thus made to limit the quantity of silica to be melted to the core to as small as possible, and provision is thus made to avoid as much as possible depositing concentric layers of silica on the preform 1 in the zones to be removed which correspond to the zones 9 and 10 shown in Figure 1.

To this end, in the invention, during the deposition of the succession of layers and starting from one of the intermediate layers, provision is made to interpose, during at least one pass, a one-ended reduction in the length of the layer of material deposited in said pass. The length of each concentric layer is a function of the length of relative displacement provided between the preform and the torch 5 in operation along the longitudinal axis 4 of said preform, for the purpose of depositing said layer.

A preform 1' obtained by implementing the method of the invention is made from a commonly-used primary preform 2', of circularly cylindrical appearance, carried at its ends by end-pieces 6a' and 6b', as shown in Figure 2. During a first portion of the succession of material-depositing operations, the concentric layers are progressively shortened at either end of a central segment, as defined by a variation relationship that is, for example, linear and that is imposed by the preform/torch relative displacements. As a result of this shortening, the ends of the preform being overclad

tend to constitute points, with each end taking up an approximately conical appearance.

A one-ended reduction in layer length is imposed by a corresponding reduction in the relative displacement between the torch and the preform. This one-ended reduction is performed during an overcladding pass during which the preform 1' being overclad is overclad with a layer of material. The reduction is, for example, set to a value L1 lying in the range 10 millimeters to 200 millimeters. For example, it may be triggered when a determined diameter value D1 is reached for the preform being overclad, as a result of the successive depositions of material during the passes, which passes have led to a predetermined number of layers being formed. The diameter value D1 is chosen to be greater than the diameter of the end-piece 6b', and preferably less than 70 millimeters.

The deposition of the concentric layers is then continued on the preform 1a starting from the layer whose length has been reduced at one end, the deposition being continued with a relationship of decreasing variation in length which is optionally the same decreasing relationship as used previously for the layers which, by being superposed, made it possible to reach the thickness of material corresponding to the diameter D1. This decreasing relationship is, for example, a linear relationship leading to a circularly-symmetrical intermediate segment being obtained between the cylindrical central portion of the overclad preform 1' and the cylindrical segment 10' of diameter D1 which results from the one-ended reduction in length performed at the end at which the end-piece 6b' is situated. In practice, said decreasing relationship results in a series of setpoints whose characteristics are supplied to a programmable logic controller (not shown) which is assigned to controlling the preform/torch displacements. The decreasing relationship is assumed to be the same for

both ends of the preform in the example shown in Figure 2.

A different decreasing relationship may also be considered, firstly for each preform end, and secondly for the intermediate portion connecting the cylindrical central segment of the preform to the cylindrical segment 10'. The purpose of this is to obtain one preform end whose shape, after removal of the end-piece 6b', differs from that of a cone, e.g. by being substantially bulb-shaped. Preferably the variation relationship is chosen to obtain an unbroken curved connection between a circularly-symmetrical intermediate segment and the cylindrical central segment of the preform.

A non-linear decrease makes it possible, for example, to obtain a pointed end, united with the central segment by a curved junction whose appearance is that of a paraboloid of revolution which curves without any discontinuity in the zone where it joins the central segment.

It is also possible to make a cylindrical segment 10' which does not correspond to an exact circular cylinder insofar as, for example, it is slightly frustoconical.

In any event, it is necessary to separate the end piece 6b' from the resulting preform 1' in order to enable fiber-drawing to be performed. The separation is effected in that limited-length zone of the preform which is adjacent to the end-piece and which makes up the cylindrical segment 10' with it. As is known, the interface zone, where an end-piece is united with a preform, is not used for fiber-drawing because it is not sufficiently homogeneous as a result of the glass-glass weld by means of which the end-piece and the preform are secured together.

The separation is effected by drawing the glass constituting the segment 10' which is made locally soft by being heated to the core by means of the plasma torch

5, in the zone of the preform that includes the segment 10' and that is adjacent to the end-piece. This drawing is performed by exerting axial traction in opposite directions via the end-pieces 6a' and 6b'. It results in the link that existed between the preform 1' and its end-piece 6b' being cleaved, as shown diagrammatically in Figure 3. This cleaving is facilitated by the intensive heating being localized, as created by the heating to the core for the purpose of softening the glass by melting it, in a portion of the segment 10' and by the fact that the segment is of small diameter relative to the central segment of the preform 1'.

A substantially conical shape is obtained at that end of the preform which has been broken away from the end-piece 6b' and from the residual portion of preform 9' that the end-piece continues to support after separation.

As indicated, the choice of the shape of the end of the preform that is best suited to fiber-drawing is obtained by acting on the factors involved in the separation stage performed by drawing, and in particular on the length variation relationship chosen for the superposed concentric layers of the junction between the central cylindrical segment of the overclad preform 1' and the segment 10'.

This makes it possible to avoid having to perform the separation on a preform end that has a diameter corresponding to the diameter of the central segment of the preform, when said diameter reaches the above-mentioned value limit above which the operations performed by means of a plasma torch become lengthy and difficult to perform. This limitation in diameter offers the advantage of involving only limited traction forces for performing the drawing operation.

In addition, the duration of the separation operation is reduced because the diameter of the segment 10' is itself limited compared with the overall outside diameter of the preform. This also limits the unwanted

quantity of silica re-deposited during the heating to the core.

CLAIMS

1/ A method of manufacturing or building up, i.e. "overcladding", an optical fiber preform in an installation provided with means enabling a preform held horizontally at its ends between two mounting points by supporting end-pieces to be rotated axially and to be moved relatively in translation, said installation also being provided with heater means for heating the preform by means of a plasma torch, which heater means are disposed radially relative to said preform and are associated with material supply means, so as to enable the preform to be manufactured in successive passes corresponding to the preform and the torch being displaced relative to each other, with or without material being supplied, these displacements therefore leading either to a new layer of material being deposited on the preform, or to the most recent layer deposited being glazed, said method interposing a one-ended reduction in the length of at least one layer, during a pass and starting from one of the intermediate layers, while a succession of concentric layers of material are being deposited on the preform in a manner such that the respective lengths of the layers, which lengths are determined by the preform/torch relative displacements, are progressively shortened as a result of a progressive reduction in the lengths of the displacements, so that the thickness of deposited material that covers the preform and a portion of each of the end-pieces decreases uniformly towards the ends, said one-ended reduction in layer length leading to a limitation of the thickness of material deposited on one of the end-pieces and on a limited-length preform zone that is longitudinally adjacent to said end-piece, at the level set by the layer deposited immediately prior to said one-ended reduction.

2/ A method according to claim 1, wherein the one-ended reduction is performed after depositing a determined

number of concentric layers leading to a given preform diameter.

3/ A method according to claim 2, wherein the given preform diameter, above which a one-ended reduction in layer length is performed is greater than the diameter of the end-piece in question, and less than 70 millimeters.

4/ A method according to claim 1, wherein provision is made for the one-ended reduction in layer length to lie in the range 10 millimeters to 200 millimeters.

5/ A method according to claim 1, providing a reduction in layer length that satisfies a linear relationship, at least beyond the layer whose length is reduced at one end and that is deposited first, and at that end of the preform at which said reduction is provided.

6/ A method according to claim 1, providing a reduction in layer length that satisfies a non-linear decreasing relationship, at least beyond the layer whose length is reduced at one end and that is deposited first, and at that end of the preform at which said reduction is provided.

7/ A method according to claim 1, including at least one hot drawing operation performed to separate a preform from one of the end-pieces in said limited-length preform zone which is adjacent to said end-piece, after said succession of layers required for forming the preform has been deposited.

8/ A method according to claim 1, including a hot-drawing operation performed in two steps, separated by a preform glazing operation, in said limited-length preform zone which is adjacent to an end-piece so as to separate the preform and said end-piece, the first drawing step being

associated with heating to the core causing softening by melting in said limited-length preform zone, and producing a reduction in diameter, the second step also being associated with heating to the core causing softening by melting and achieving full separation.

A B S T R A C T

The method is designed to be implemented in an installation provided with means enabling a preform held between two points by supporting end-pieces to be rotated and to be moved in translation. Heater means for heating the preform by means of a plasma torch are associated with material supply means, so as to enable the preform to be manufactured in layers. Preform/torch relative displacements, with or without material being supplied, lead either to a new layer of material being deposited on the preform, or to the most recent layer deposited being glazed. Said method interposes a one-ended reduction in layer length, starting from one of the intermediate layers, while a succession of concentric layers are being deposited on the preform in a manner such that the lengths of the layers are progressively reduced so that the preform tapers towards it ends. The one-ended reduction leads to a limitation of the thickness of a determined segment at the level of the layer deposited immediately prior to the reduction.

FIG_1

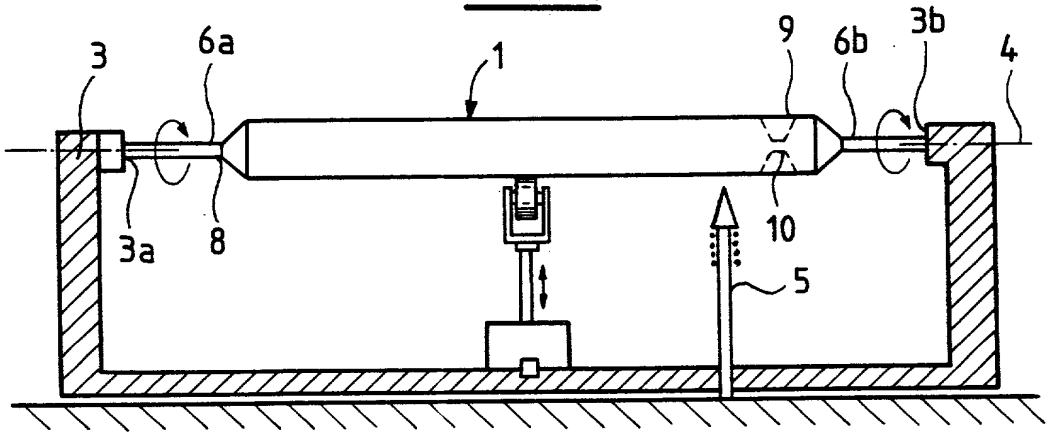


FIG_2

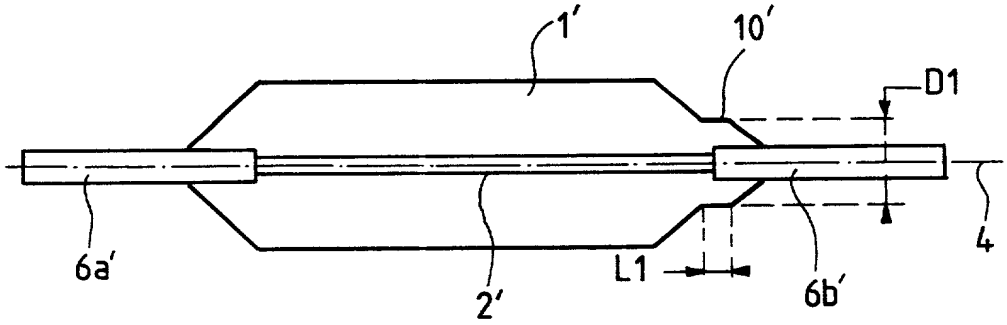
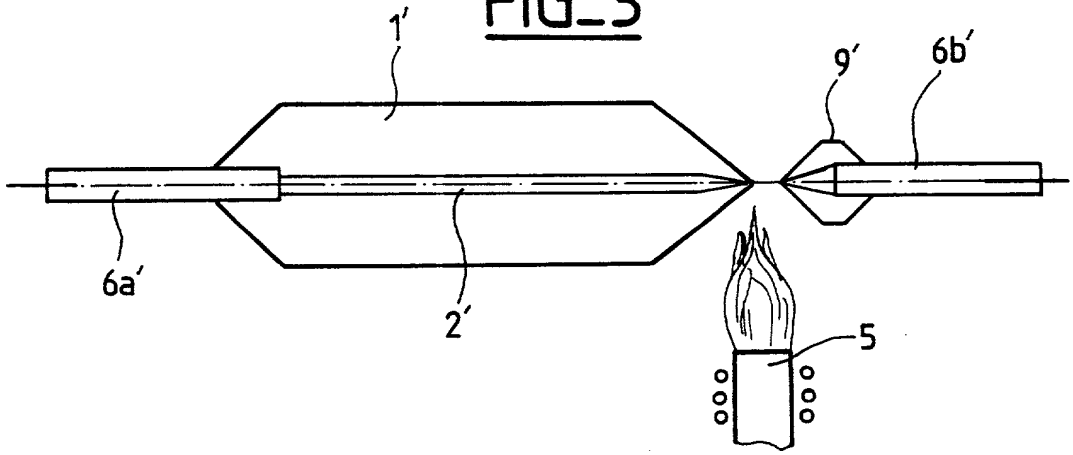


FIG_3



Declaration and Power of Attorney for Patent Application

Déclaration et Pouvoirs pour Demande de Brevet

French Language Declaration

En tant que l'inventeur nommé ci-après, je déclare par le présent acte que:

As a below named inventor, I hereby declare that:

Mon domicile, mon adresse postale et ma nationalité sont ceux figurant ci-dessous à côté de mon nom.

My residence, post office address and citizenship are as stated next to my name.

Je crois être le premier inventeur original et unique (si un seul nom est mentionné ci-dessous), ou l'un des premiers co-inventeurs originaux (si plusieurs noms sont mentionnés ci-dessous) de l'objet revendiqué, pour lequel une demande de brevet a été déposée concernant l'invention de la description identifiée par le numéro de référence

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention in the specification identified by Docket No.

102320/VF/TEL

Je déclare par le présent acte avoir passé en revue et compris le contenu de la description ci-dessus, revendications comprises.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

Je reconnais devoir divulguer toute information pertinente à la brevetabilité, comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

Je revendique par le présent acte avoir la priorité étrangère, en vertu du Titre 35, § 119(a)-(d) ou § 365(b) du Code des Etats-Unis, sur toute demande étrangère de brevet ou certificat d'inventeur ou, en vertu du Titre 35, § 365(a) du même Code, sur toute demande internationale PCT désignant au moins un pay autre que les Etats-Unis et figurant ci-dessous et, j'ai aussi indiqué ci-dessous toute demande étrangère de brevet, tout certificat d'inventeur ou toute demande internationale PCT ayan une date de dépôt précédant celle de la demande à propos de laquelle une priorité est revendiquée.

I hereby claim foreign priority under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below, and have also identified below any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign application(s) for which priority is claimed
Demande(s) de brevet étrangère(s) antérieure(s) dont la priorité est revendiquée

(Number) (Numéro)	(Country) (Pays)	(Day/Month/Year Filed) (Jour/Mois/Année de dépôt)
99 04 074	FRANCE	01 APRIL 1999

Prior foreign applications for which priority is not claimed
Demande(s) de brevet étrangères antérieure(s) dont la priorité n'est pas revendiquée

(Number) (Numéro)	(Country) (Pays)	(Day/Month/Year Filed) (Jour/Mois/Année de dépôt)

French Language Declaration

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 119(e) du Code des Etats-Unis, de toute demande de breve provisoire effectuée aux Etats-Unis et figurant ci-dessous.

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

(Application No.) (No de demande)	(Filing Date) (Date de dépôt)

Je revendique par le présent acte tout bénéfice, en vertu du Titre 35, § 120 du Code des Etats-Unis, de toute demande de brevet effectuée aux Etats-Unis, ou en vertu du Titre 35, § 365(c) du même Code, de toute demande internationale PCT désignant les Etats-Unis et figurant ci-dessous et, dans la mesure où l'objet de chacune des revendications de cette demande de brevet n'est pas divulgué dans la demande antérieure américaine ou internationale PCT, en vertu des dispositions du premier paragraphe du Titre 35, § 112 du Code des Etats-Unis, je reconnais devoir divulguer toute information pertinente à la brevetabilité, comme défini dans le Titre 37, § 1.56 du Code fédéral des réglementations, dont j'ai pu disposer entre la date de dépôt de la demande antérieure et la date de dépôt de la demande nationale ou internationale PCT de la présente demande.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application No.) (N0 de demande)	(Filing Date) (Date de dépôt)	(Status)(patented, pending, abandoned) (Statut)(breveté, en cours d'examen, abandonné)

Je déclare par le présent acte que toute déclaration ci-incluse est, à ma connaissance, véridique et que toute déclaration formulée à partir de renseignements ou de suppositions est tenue pour véridique; et de plus, que toutes ces déclarations ont été formulées en sachant que toute fausse déclaration volontaire ou son équivalent est passible d'une amende ou d'une incarcération, ou des deux, en vertu de la Section 1001 du Titre 18 du Code des Etats-Unis, et que de telles déclarations volontairement fausses risquent de compromettre la validité de la demande de brevet ou du brevet délivré à partir de celle-ci.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

French Language Declaration

POUVOIRS: En tant que l'inventeur cité, je désigne par la présente l'(les) avocat(s) et/ou agent(s) suivant(s) pour qu'ils poursuive(nt) la procédure de cette demande de brevet et traite(nt) toute affaire s'y rapportant avec l'Office des brevets et des marques: (mentionner le nom et le numéro d'enregistrement).

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

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Signature de l'inventeur Date	Inventor's signature Date 23/02/2000
Domicile	Residence 95310 SAINT OUEN L'AUMONE, FRANCE
Nationalité	Citizenship French
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Nom complet du second co-inventeur, le cas échéant	Full name of second joint inventor, if any (First Middle Last) Rémi FAUCHE
Signature du second inventeur Date	Second inventor's signature Date 28/02/2000
Domicile	Residence 78260 ACHERES, FRANCE
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Adresse postale	Post Office Address 3, rue François Truffaut 78260 ACHERES, FRANCE

(Fournir les mêmes renseignements et la signature de tout co-inventeur supplémentaire.)

(Supply similar information and signature for third and subsequent joint inventors.)

nch Language Declaration

Nom complet du troisième co-inventeur, le cas échéant	Full name of third joint inventor, if any (First Middle Last) Jean-Florent CAMPION
Signature du troisième l'inventeur Date	Third inventor's signature Date 23/02/2009
Domicile	Residence 78700 CONFLANS ST HONORINE, FRANCE
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Nom complet du quatrième co-inventeur, le cas échéant	Full name of fourth joint inventor, if any (First Middle Last)
Signature du quatrième l'inventeur Date	Fourth inventor's signature Date
Domicile	Residence
Nationalité	Citizenship
Adresse postale	Post Office Address
Nom complet du cinquième co-inventeur, le cas échéant	Full name of fifth joint inventor, if any (First Middle Last)
Signature du cinquième l'inventeur Date	Fifth inventor's signature Date
Domicile	Residence
Nationalité	Citizenship
Adresse postale	Post Office Address
Nom complet du sixième co-inventeur, le cas échéant	Full name of sixth joint inventor, if any (First Middle Last)
Signature du sixième l'inventeur Date	Sixth inventor's signature Date
Domicile	Residence
Nationalité	Citizenship
Adresse postale	Post Office Address